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## **Financial Transaction Tax and Market Quality: Evidence from France**

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### **Abstract**

The effectiveness of Financial Transaction Taxes (FTTs) for deterring speculative trading and improving market quality remains controversial. Studying the FTT imposed in 2012 on large-cap stocks traded on the Euronext Paris, we find that stocks subject to the FTT subsequently experience significantly decreased turnover and increased spreads relative to the untaxed peers. Further tests suggest that the FTT imposition induces investors to migrate their trades and results in less informativeness in the taxed stocks. Collectively our findings support the view that FTTs deter informed trades and reduce market quality.

### **Keywords:**

Financial Transaction Tax; Liquidity; Trade Migration; Information Content of Trades

## 1. Introduction

The taxation of financial transactions, practiced in many countries including 19 G20-members (Burman et al 2016), is often promoted as a deterrent to speculative trading, excessive volatility and financial short-termism. However, the effectiveness of a financial transaction tax (FTT) in improving market quality remains controversial among researchers.<sup>1</sup> A growing literature indicates that it may not achieve the intended objectives. Gruenfest and Shoven (1991) demonstrate that the mere proposal of an FTT in the US reduced trading volumes and market liquidity. Ross (1989) concludes that an FTT is ineffective in reducing speculative trading. Although Deng, Liu and Wei (2018) show that, on average, there is a negative relation between stamp duty increase and price volatility in China, the authors find that the opposite effect is true when institutional investors become significant market participants. Meanwhile, the effects of FTT have also been heatedly debated among practitioners and media.<sup>2</sup>

In this paper, we examine the FTT introduced in 2012 on large-cap stocks traded on the Euronext Paris. The European Union Commission presented a proposal for an FTT in 2011 and argued that the tax would reduce competitive distortions in the single market, discourage risky speculative trading activities and avoid future financial crises.<sup>3</sup> After much controversy on the FTT among EU member-countries, starting from 1 August 2012, France implemented the tax on 109 Euronext Paris-traded stocks that had a market capitalization over one billion euros as of January 1<sup>st</sup> 2012.<sup>4</sup> This setting

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<sup>1</sup> See Schwert and Seguin (1993) and Burman et al (2016) for arguments for and against an FTT.

<sup>2</sup> See, for instance, the Financial Times article via the link <https://www.ft.com/content/5a0c9816-41b9-11e9-9499-290979c9807a>, and the article of New York Times available online at <https://www.nytimes.com/2016/01/28/opinion/the-need-for-a-tax-on-financial-trading.html>.

<sup>3</sup> The statement is available online at: [http://ec.europa.eu/commission\\_2010-2014/semeta/headlines/news/2011/09/201109282\\_en.htm](http://ec.europa.eu/commission_2010-2014/semeta/headlines/news/2011/09/201109282_en.htm).

<sup>4</sup> Starting from 2013, the FTT target list will be updated at the beginning of each year and include stocks issued by French companies with a market capitalization over one billion euros on December 1<sup>st</sup> of the previous year.

provides a rich laboratory to investigate the effect of the FTT imposition investor trading and market quality.

We first find that the liquidity of stocks subject to the FTT deteriorates after the FTT implementation in the univariate difference-in-difference (DID) test. Specifically, relative to their untaxed peers on the Euronext Paris, stocks subject to the FTT experience significantly reduced turnover and increased transaction costs from the pre-tax period to the post-tax period. Compared to the untaxed stocks, the turnover ratio for the taxed stocks declines by 0.069%, while the bid-ask spread and the Roll's spread measure increase by 0.330% and 0.215% respectively. These changes are economically significant either in the absolute sense by their own magnitude or relative to the average value of these measures for the taxed stocks in the pre-tax period, which is 0.304%, 0.194% and 0.581% for the turnover, the bid-ask spread and the Roll's spread measure respectively.

As our sample stocks subject to the FTT were determined solely based on their market capitalization as of January 1<sup>st</sup> 2012, it is natural to question whether our results above are driven by the difference in size or other firm characteristics between the taxed stocks and their untaxed peers. We first partially address this concern by running a multivariate regression that controls size and other firm characteristics while preserving the DID inference. The results are almost identical to those in the univariate DID test, in terms of both the point estimate and the statistical significance. We further consider an alternative control group that includes stocks listed on the London Stock Exchange and having a market capitalization over one billion euros as of January 1<sup>st</sup> 2012, the same size cut-off for

the FTT target stocks. We find similar results of decreased turnover and increased spreads for the French taxed stocks relative to their UK large-cap counterparts.<sup>5</sup>

Given the evidence of liquidity deterioration in the taxed stocks, it is rational for investors to substitute the taxed stocks with overseas large firms sharing similar fundamentals to achieve similar investment objectives at lower costs. We identify target stocks' potential trading substitutes among UK large stocks, since they share similar size, industry and other firm characteristics with the French taxed stocks. We measure the similarity in fundamentals between a pair of stocks by the partial correlation in returns after controlling for both the French and UK market returns, and then for each taxed stock, we select its potential trading substitute as the one that had the highest partial return correlation with it in the pre-FTT period, among all the large stocks with a market capitalization over one billion euros in the UK equity market. We find that these potential trading substitutes experience increased turnover in the post-FTT period, compared with either the taxed stocks or other UK large ones, which is consistent with investors migrating from the taxed stocks to UK large firms with similar fundamentals and industries. We also find similar evidence of trading migration from taxed stocks to untaxed ones within the French equity market.

As more sophisticated investors are more likely to engage in trading migration, we expect the trades in the taxed stocks to become less informative after the FTT imposition. We decompose a stock's price impact of trades into the permanent versus transitory components following procedures in Glosten and Harris (1988) and Sadka (2006). The permanent price impact is likely to capture the impact of informed trading, while the transitory component is likely due to noise trading. The

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<sup>5</sup> The United Kingdom has charged a Stamp Duty Reserve Tax at 0.5% for share purchase since 1986. There was no significant change of transaction tax policy in the United Kingdom during our sample period, and the British government opposed the 2011 European FTT proposal.

univariate DID test shows that the transitory price impact of the taxed stocks increases significantly, while the permanent price impact decreases, relative to the untaxed peers in the post-FTT period. These results indicate that the FTT not only impedes liquidity, but also results in less informative trades and thus more noisy stock prices, opposite to the policy's intended objective to deter speculative trading and reduce price distortion.

Our paper is closely related to existing studies using the introduction of the FTT in France in 2012 to examine the effect of the FTT on market quality. Most existing studies focus only on trading volumes and transaction costs for their analyses. For example, Becchetti, Ferrari and Trenta (2013) and Meyer, Wagener and Weinhardt (2015) document decreased trading volumes for the taxed stocks after the FTT. Gomber, Haferkorn and Zimmermann (2016) find increased relative spreads and decreased order book depth for the taxed stocks after the FTT. The exception is Colliard and Hoffman (2017) who not only find a lower volume and reduced liquidity for the taxed stocks after the FTT, but also show a shift in stock holdings from short-term to long-term investors.

Our study differs from these studies in two important ways. First, we find evidence of trading migration from the taxed stocks to their potential trading substitutes, e.g., UK large stocks or those untaxed stocks in the French equity market. Our finding of the shift in trading across stocks after the FTT supplements the finding of the shift in holding across investors in the taxed stocks. Second, we show that the FTT results in less informative trades in the taxed stocks.

Our paper is also related to existing studies on the FTT using events in other countries. Umlauf (1993) reports decreased trading volume following the introduction of an FTT in Sweden. Pomeranets and Weaver (2018) analyze historical levels of securities transaction tax in the U.S. between 1932 and 1981 and find that raising the tax increases relative spreads and decreases trading volumes. Deng, Liu

and Wei (2018) find a significantly negative relationship between the stamp duty increase and share price volatility in China, but an opposite effect occurs if there is a significant portion of institutional investors. Using the recent FTT introduction in France, our study not only complements these studies with further evidence on the relationship between the FTT and the market quality but also, more importantly, provides *new* evidence on the effect of FTT on trading migration and informed trading, which corroborates the finding about the institutional investors in Deng, Liu and Wei (2018).

The remainder of this paper is structured as follows: Section 2 introduces the background of the FTT in France; Section 3 describes the sample, variable construction and data sources in this study; Section 4 reports the empirical methodology and results; finally, Section 5 concludes.

## **2. Background Information about the French FTT**

The French FTT took effect on August 1<sup>st</sup> 2012 and initially covered three types of transactions: the acquisition of equity securities, the high-frequency trading (no longer subjective to the FTT from January 1<sup>st</sup> 2018), and credit default swaps against EU sovereign debts. The specific FTT of our interest is the one applied to share purchases, which was initially set as 0.2% (0.3% since January 2<sup>nd</sup> 2017) of the net purchase per settlement date. For the initial implementation on August 1<sup>st</sup> 2012, the FTT applied to securities issued by French companies with the market capitalization above one billion euros on January 1<sup>st</sup> 2012. The list of target securities would be updated at the beginning of each later year based on companies' market capitalization on December 1<sup>st</sup> in the previous year.<sup>6</sup>

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<sup>6</sup> More details about the French FTT could be found at <http://www.amafi.fr/download/pages/R7pBzHkbKhtSjKUOWUokfdACCAvxu6wh5pcJs4Qr.pdf> and [https://www.bnymellon.com/emea/en/\\_locale-assets/pdf/our-thinking/ftt-globalperspective-brochure-03-2018.pdf](https://www.bnymellon.com/emea/en/_locale-assets/pdf/our-thinking/ftt-globalperspective-brochure-03-2018.pdf)

Implementation of the FTT has had many controversies in the European Union. The FTT proposal initially was supported by 11 EU member states. The European Commission expected that the tax would help reduce competitive distortions in the unified market, discourage speculative trading activities and complement regulatory measures aimed at avoiding future crises. However, there have been inconclusive debates about the FTT proposal in some EU member countries. In particular, the British government expressed strong sentiment against the regulation.<sup>7</sup>

### **3. Sample, Data Sources and Variable Measurement**

Our sample includes stocks traded on the Euronext Paris over the period January 2012 to March 2013. We divide our sample period into two six-month segments (hereinafter referred to as “subperiods”): the pre-regulation period from January 1<sup>st</sup> to June 30<sup>th</sup> 2012 and the post-regulation period from October 1<sup>st</sup> 2012 to March 31<sup>st</sup> 2013. We choose six-month pre- and post-regulation periods to balance the trade-off between the test power and the potential contamination by confounding events. As some irregular trading could happen around the implementation date of the FTT, we exclude the FTT implementing month August 2012 and the two neighbouring months for a cleaner identification of pre- and post-regulation periods.

We obtain the list of the 109 stocks subject to the FTT (hereinafter referred to as “target stocks”) from the French government website (see Table A.1 in the Appendix for detailed information).<sup>8</sup> The

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<sup>7</sup> Information about the debate on the FTT proposal in the European Union member countries is available online at:

<http://www.bloomberg.com/news/2011-11-08/eu-transaction-tax-debate-highlights-euro-area-disagreement.html>

<sup>8</sup> The list is available online at:

<http://www.legifrance.gouv.fr/affichTexte.do?sessionId=?cidTexte=JORFTEXT000026178804&dateTexte=&oldAction=rechJO&categorieLien=id>

rest of stocks traded on the Euronext Paris (hereinafter referred to as “non-target stocks”) form our control group for the target stocks. For a stock to be included in our sample, it must have valid values in both subperiods for at least one of the three employed liquidity measures, which will be defined shortly. Our base sample stocks include 108 target stocks, as one of the target stocks (APRR) was delisted from the Euronext Paris on December 18<sup>th</sup> 2012, and 623 non-target stocks. The number of included stocks may vary across tests due to the availability of individual variables.

For our baseline tests, we employ three measures of liquidity: the share turnover, the bid-ask spread, and the Roll’s spread measure, all of which are calculated from daily data.<sup>9</sup> For each stock, the daily share turnover is calculated as the ratio of daily number of shares traded to the number of shares outstanding, and the daily bid-ask spread is calculated as  $(ask - bid) / (ask + bid)$ , where ask and bid are the daily close ask and bid prices. We then average daily values of these two measures separately within the pre-regulation period and the post-regulation period for each stock. Following Roll (1984), the Roll’s spread measure is calculated as  $2\sqrt{-Cov}$ , separately within the pre-regulation period and the post-regulation period for each stock, where Cov is the sample autocovariance of daily returns and is set to zero if positive. For the calculation of each liquidity measure for a stock in a subperiod, we require a minimum of 50% valid daily observations of the stock in the period.

We also collect the set of firm characteristics shown to affect stock liquidity in the previous studies, e.g., Aslan, Easley, Hvidkjaer and O’Hara (2011), as the control variables in our regression analysis. Size is measured as the market capitalization in billions of Euros at the end of 2011 for each

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<sup>9</sup> According to Goyenko, Holden and Trzcinka (2009), spread measures calculated from daily data approximate well for high-frequency transaction cost benchmarks. Our results also hold when using the Amihud illiquidity measure (Amihud (2002)). However, as there are some missing values for Amihud illiquidity measure due to zero daily trading volume, we report the results of the robustness check using the Amihud illiquidity measure in Table A.3 in the Appendix.

stock. Volatility is calculated as the standard deviation of daily returns for each stock in 2011, which is then multiplied by the square root of 252 to obtain the annualized value. Sales Growth is the percentage increase in sales from the 2010 financial year to the 2011 financial year for each firm. CapEx is the capital expenditure in the 2011 financial year scaled by the total assets at the end of 2011 financial year for each firm. Analyst is the number of analysts making one-year-ahead earnings forecasts for a firm in December 2011 and is set to zero for firms not covered by any analyst. Institutional Ownership is calculated for each stock as the percentage of shares outstanding held by institutional investors at the end of 2011 and set to zero if not held by any institutional investor. Firm Age is measured for each firm as the difference between our sample ending year 2013 and the first year when the firm's stock appeared in the daily market data.

We obtain daily close bid and ask prices from Datastream, other daily market data and annual financial statement data from Compustat Global, analyst earnings forecasts from IBES, institutional holdings data from Factset, and intraday transaction and quote data from Thomson Reuters Tick History (TRTH) database.<sup>10</sup> Table 1 reports the summary statistics of liquidity measures and other firm characteristics for our sample stocks. For the three liquidity measures, we report their statistics separately for the pre-regulation period and the post-regulation period. All variables are winsorized cross-sectionally at the 1<sup>st</sup> and 99<sup>th</sup> percentile values.

**<< Table 1 goes about here >>**

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<sup>10</sup> We include only valid quotes with a positive bid-ask spread. For daily market data in Compustat Global, we drop leading or trailing consecutive observations of each stock with zero return and volume, as they are likely due to data errors.

## 4. Empirical Analyses

### 4.1. The Liquidity Effect of the FTT

In this section we investigate how the liquidity of stocks subject to the FTT (referred as “target stocks” hereafter) changes after the FTT implementation. We first adopt a univariate DID test to compare the change in liquidity measures of target stocks with that of French stocks not subject to the FTT (referred as “non-target stocks” hereafter). For each of the three liquidity measures defined in Section 3, we report the following statistics for both the target stock group and the non-target stock group: the average value in the pre-regulation period, the average value in the post-regulation period, and the average change from the pre-regulation period to the post-regulation period. When calculating the average value of a variable for a group, we weight stocks either equally or by its market capitalization. Finally, we report the difference in these statistics between the target stock group and the non-target stock group and the associated t-value from a standard T-test.<sup>11</sup>

The DID test results, which are reported in Table 2, show that target stocks experience a declined turnover and increased spreads relative to their non-target peers after the FTT imposition. Focusing on the equal-weighted average values, target stocks have a decrease of 0.069% in turnover, an increase of 0.330% in the bid-ask spread and an increase of 0.215% in the Roll’s measure respectively from the pre-regulation period to the post-regulation period, compared with all non-target stocks. As shown in the table, the average value is 0.304%, 0.194% and 0.581% for turnover, the bid-ask spread and the Roll’s spread measure respectively for target stocks in the pre-regulation period. Hence the relative

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<sup>11</sup> Besides using all non-target stocks for benchmarking, we also consider target stocks’ non-taxed industry peers identified by the 2-digit Global Industry Classification Standard (GICS) industry code as an alternative benchmark group. For each taxed stock in each industry, we choose, without replacement and subject to availability, up to N (N = 1, 3, and 5) largest non-taxed stocks in the same industry as control stocks. We report the results of the DID tests with these alternative control stocks in Table A.4 in the appendix. Overall the results indicate a post-regulation deterioration in liquidity for taxed stocks relative to their untaxed peers.

changes in these liquidity measures are not only statistically significant but also economically significant, whether in the absolute sense by their own magnitude or in the relative sense by comparing with the pre-regulation average values of these measures. The results by using the value-weighted average values paint a very similar picture.

<< **Table 2 goes about here** >>

It is worth noting that for both the bid-ask spread and the Roll's spread measure, the pre-to-post-regulation change by its own is either negative or insignificantly positive for target stocks. We argue that this is due to the overall change in the market state and liquidity over our sample period.<sup>12</sup> As shown in Figure A.1 in the Appendix, CAC 40 Index, a benchmark French stock market index, increases significantly from the pre-regulation period to the post-regulation period. As in general the stock liquidity is positively correlated with the overall market return (Hameed, Kang and Viswanathan, 2010), on average the spread of French stocks decreases from the pre-regulation period to the post-regulation period, which is confirmed by the change in spread measures for both target and non-target stocks as reported in Table 2. Hence it is important to control for the overall trend in liquidity when inferring the effect of FTT, which is exactly the spirit of the DID test.

Our DID tests subject to the concern that the results could be driven by differences in firm characteristics, especially firm size, between target stocks and the benchmark group, rather than by the FTT treatment effect. This is a valid concern as target stocks are determined solely based on their market capitalization as of January 1<sup>st</sup> 2012. We conduct two further tests to address this concern.

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<sup>12</sup> If we subtract daily liquidity measures of individual stocks by the corresponding cross-sectional average value of all sample stocks, the post- versus pre-regulation changes in mean-adjusted liquidity measures all show the expected sign and are mostly significant for target stocks, indicating deterioration in liquidity among target stocks post regulation.

In our first additional test, we run a multivariate panel regression as specified in equation [1] that controls size and other firm characteristics while preserving the DID inference:

$$[1] \text{ Liquidity}_{i,t} = \beta_0 + \beta_1 * \text{DM\_Target}_{i,t} + \beta_2 * \text{DM\_Post}_{i,t} + \beta_3 * \text{DM\_Target\_Post}_{i,t} + \text{Controls.}$$

We run the regression with stock-subperiod observations, where subperiods refer to pre- and post-regulation periods. The dependent variable is a stock's average or estimated value of the relevant liquidity measure in a subperiod. DM\_Target is a dummy variable taking the value one for target stocks and zero otherwise. DM\_Post is a dummy variable taking the value one for the post-regulation period and zero otherwise. DM\_Target\_Post, the multiplication of these two dummy variables, is the variable of interest, as its coefficient measures the pre-to-post-regulation change in liquidity for target stocks relative to non-target stocks. We control for the following firm characteristics that are defined in Section 3: the natural logarithm of Size, the natural logarithm of Volatility, Sales Growth, CapEx, the natural logarithm of (1+Analyst), the natural logarithm of (1+ 100\*Institutional Ownership), and the natural logarithm of Age. We further include in the regression the dummy variable DM\_CAC40, which takes the value one for CAC 40 index components as of the end of 2011 and zero otherwise, and industry fixed effects, where industries are defined based on 2-digit GICS codes.

Table 3 reports regression coefficients and the associated t-values calculated from standard errors clustered at the firm level.<sup>13</sup> In all three regressions with different liquidity measures as the dependent variable, the variable DM\_Target\_Post carries a statistically significant coefficient of the expected sign. Compared with non-target stocks, target stocks on average experience a decrease of 0.070% in

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<sup>13</sup> As there are only two subperiod observations for each stock, we are not able to cluster standard errors by subperiod. We run an alternative panel regression using stock-date observations with daily turnover or daily bid-ask spread as the dependent variable and cluster standard errors by both stock and date. We obtain very similar results in terms of both the point estimate and the statistical significance.

turnover, an increase of 0.279% in in the bid-ask spread and an increase of 0.280% in the Roll's spread measure respectively from the pre-regulation period to the post-regulation period, after controlling for size and other firm characteristics. The estimated liquidity effects of the FTT are very close to those in the univariate DID tests.

<< **Table 3 goes about here** >>

Our second additional test further addresses the issue of size difference between target stocks and non-target stocks by using large stocks listed on London Stock Exchange as an alternative control group in the univariate DID test. Specifically, we select stocks listed on the London Stock Exchange and having a market capitalization over one billion euros as of January 1<sup>st</sup> 2012, the same size cut-off for the FTT target stocks. These stocks were similar to the French FTT target stocks in terms of firm size but did not experience a change in the transaction tax during our sample period, as there was no change in the transaction tax policy in the United Kingdom during that period. We repeat the univariate DID test with these UK large stocks as the control group and report the results in Table 4. In five out of the six specifications, we find a significant deterioration in liquidity, i.e., a decreased turnover or an increased spread, in the post-FTT period for target stocks relative to the UK large stocks.<sup>14</sup> The only exception is for the equal-weighted average bid-ask spread, for which the difference is of the expected sign but not statistically significant. The overall results of this additional DID test indicate that the liquidity effect of the FTT is not driven by the size difference between target stocks and non-target stocks.<sup>15</sup>

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<sup>14</sup> We would like to emphasize that these DID results are not due to different liquidity trends between two markets over the sample period. In an additional but untabulated DID test, we do not find any significant difference in pre-to-post-regulation change in liquidity between the French non-target stocks and the UK mid-cap or small stocks with a market capitalization below one billion euros as of January 1<sup>st</sup> 2012.

<sup>15</sup> To further address the concern that our control group may include very illiquid small stocks, we replicate our baseline analysis in Table 2 by dropping those French non-taxed stocks with the market capitalization below the

<< **Table 4 goes about here** >>

Overall we find a significant liquidity-dampening effect of the FTT in both univariate DID tests and multivariate regression analyses, which is consistent with findings in existing studies of the French FTT such as Becchetti, Ferrari and Trenta (2013), Meyer, Wagener and Weinhardt (2015), Gomber, Haferkorn and Zimmermann (2016), and Colliard and Hoffman (2017). Next, we will investigate investors' trading response to the regulation and the implications for information content of trades in target stocks.

#### 4.2. Trading Migration

Given the evidence of increased spreads in the taxed stocks, it is rational for investors to substitute the taxed stocks with untaxed ones sharing similar fundamentals to achieve their investment objectives at lower costs. To test this hypothesis, we identify two sets of potential trading substitutes for taxed stocks: the first set comprises of selective UK large stocks and the second one includes selective untaxed stocks listed on the Euronext Paris. From each pool of untaxed stocks (i.e., UK large stocks or French non-taxed stocks), we select the potential trading substitute of a target stock as the one that had the highest partial correlation in daily returns with the taxed one in the pre-FTT period, after controlling for the market return, among the pool of untaxed stocks.<sup>16</sup> The pair-wise partial correlation in returns should be a reasonable proxy for similarity in fundamentals between two stocks, as we believe one or both of the following assumptions are likely to hold: i) the French/UK stock market is reasonably efficient so that returns reflect fundamentals in large; and ii) correlated

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median value of all French non-taxed stocks. The results reported in Table A.5 in the appendix are qualitatively similar to those in Table 2.

<sup>16</sup> We require a minimum of 50% valid daily observations in the pre-FTT period for two stocks to calculate their partial return correlation. When calculating the pair-wise partial correlation in returns between a taxed stock and a non-taxed one, we control for both French and UK market returns if the non-taxed stock is an UK large stock and only French market return if it is a French non-taxed stock.

mispricing due to the overall investor sentiment is an insignificant contributor to the partial return correlation after controlling for the market return.

We consider UK large stocks as potential trading substitutes for taxed stocks for two reasons. First, the list of taxed stocks, as determined by the French government, comprises of Euronext-Paris-listed large stocks with their market capitalization over one billion euros as of January 1<sup>st</sup> 2012. As the firm size is typically related to many other firm characteristics and stock returns as well, it is very likely for investors to consider similar-sized stocks when choosing trading substitutes. Second, it is also interesting to examine the cross-exchange trading migration after the FTT imposition. In an untabulated comparison of firm characteristics between taxed stocks and potential trading substitutes, we find that potential trading substitutes are more similar to taxed stocks when they are selected from UK large stocks than from French non-taxed stocks. Further, about 56% of taxed stocks are identified with a trading substitute in the same GICS 2-digit industry when selecting substitutes from UK large stocks, while the proportion drops to only 20% if selecting from French non-taxed stocks. Hence, we focus on the trading migration results with UK large stocks and caution the audience when interpreting the results with French non-taxed stocks.

We then conduct a DID test of trading volume, as measured by share turnover, between “substitute stocks” that include target stocks’ potential trading substitutes identified above and “other non-target stocks” that include remaining UK large stocks or French non-taxed stocks. If investors indeed migrate their trading from taxed stocks to potential trading substitutes, we expect a relative increase of trading volume in these stocks after the FTT implementation.<sup>17</sup> The results in Table 5

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<sup>17</sup> It is unclear about the effect of trading migration on these potential substitutes’ transaction cost measures such as bid-ask spread and Roll’s spread measure.

confirm this conjecture.<sup>18</sup> Relative to other UK large stocks, the equally-weighted (value-weighted) average turnover of potential UK trading substitutes increases significantly by 0.023% (0.029%).<sup>19</sup> Accordingly, the DID results for target stocks are stronger when comparing with substitute stocks than with other non-target stocks. The comparison between potential French trading substitutes and other French non-taxed stocks shows similar results, albeit being less significant, probably due to that these “substitutes” are not as effective for reasons mentioned above.

<< **Table 5 goes about here** >>

#### 4.3. The Information Content of Trades

Policy makers and researchers advocating the FTT may argue that the tax would deter speculative trading and increase price informativeness at the cost of reduced liquidity.<sup>20</sup> We test this argument empirically by examining the information content of trades in target stocks. Specifically, we follow the methodology proposed by Glosten and Harris (1988) and Sadka (2006) to decompose stocks’ price impact of trades into the information-related and the non-information-related components, and compare changes in both components from the pre-tax to the post-tax period between target and non-target stocks.

The decomposition model proposed by Glosten and Harris (1988) separates the price impact of trades into the permanent and transitory components. The permanent price impact could be attributed

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<sup>18</sup> The number of substitute stocks is smaller than that of target stocks because some target stocks share a same substitute.

<sup>19</sup> In terms of the pre-to-post proportionate change in turnover, the difference in the equally-weighted (value-weighted) average values between potential UK trading substitutes and other UK large stocks is about 6% (11%) and statistically significant.

<sup>20</sup> An example of such argument could be found in an IMF working paper titled “Tax Financial Transactions: Issues and Evidence”, available at <https://www.imf.org/en/Publications/WP/Issues/2016/12/31/Taxing-Financial-Transactions-Issues-and-Evidence-24702>.

to the adverse selection cost caused by informed trading. The transitory price impact could be associated with inventory and order processing cost, i.e., cost of market-making. Below we briefly illustrate our decomposition method analytically.

Denote  $m_t$  the market maker's (unobservable) expectation of security value, whose innovation from trade to trade is determined by the new private information as reflected in order flows and the new public information  $y_t$ ,

$$[2] \quad m_t - m_{t-1} = D_t[\Psi + \lambda V_t] + y_t,$$

where  $D_t$  is the trade direction indicator, taking the value one for buy-initiated trades and negative one for sell-initiated trades,  $V_t$  is the trade size,  $\Psi$  and  $\lambda$  are fixed and variable permanent price-impact components respectively.

The market maker sets the (observed) transaction price  $p_t$  based on her expectation of security value plus compensation for market-making costs,

$$[3] \quad p_t = m_t + D_t[\bar{\Psi} + \bar{\lambda} V_t],$$

where  $\bar{\Psi}$  and  $\bar{\lambda}$  are fixed and variable transitory price-impact components respectively. Based on equations [2] and [3], we can write the change in transaction prices as follows,

$$[4] \quad \Delta p_t = \Psi D_t + \lambda DV_t + \bar{\Psi} \Delta D_t + \bar{\lambda} \Delta DV_t + y_t,$$

where  $DV_t$  is the product of  $D_t$  and  $V_t$ , and  $\Delta D_t$  and  $\Delta DV_t$  are changes in  $D_t$  and  $DV_t$  from the previous transaction respectively.

Equation [4] can be estimated with transaction-level data. We obtain the data on trades and quotes for our French sample stocks during the period January 2012 to March 2013 from Thomson

Reuters Tick History (TRTH) database. We drop trades and quotes outside the trading hours of the Euronext Paris. Similar to Sadka (2006), we further apply the following filters to quoted prices based on the ratio of the bid-ask spread to the midpoint of bid and ask prices (referred as the quoted spread hereafter): i) the quoted spread should be positive; ii) the quoted spread should be less than 10% if the quote midpoint is greater than or equal to 50 euros and less than 25% if the quote midpoint is less than 50 euros. We classify transactions into buyer- or seller-initiated ones using the algorithm in Lee and Ready (1991).<sup>21</sup>

Similar to Sadka (2006), we estimate the equation [4] per-stock per-month using the ordinary least squares regression and require at least 30 observations for the estimation. For each stock each month, we first scale the four estimated price-impact coefficients by the stock's average transaction price in the month, and then calculate the permanent and transitory price impacts of trading 1000 shares as  $(\Psi + \lambda * 1000)$  and  $(\bar{\Psi} + \bar{\lambda} * 1000)$  respectively. We winsorize the price-scaled price impact coefficients cross-sectionally within each month at 1 and 99 percentile values respectively before the calculation of permanent and transitory price impacts. We then calculate the average values of the permanent and transitory price impacts in the pre-regulation period and the post-regulation period separately for each stock.

Table 6 reports the summary statistics, separately for two subperiods, for the permanent and transitory price impacts and their fixed and variable components. The number of stocks drops

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<sup>21</sup> Specifically, trades with price higher (lower) than the prevailing quote midpoint are classified as buyer(seller)-initiated. For a trade that cannot be signed by the comparison of price and quote midpoint, we define it a buyer(seller)-initiated one if its price is above (below) that of the previous trade on the same day. If the trading sign still cannot be determined for a trade, we use the sign of the previous trade on the same day. All unsigned trades after the above procedure are deleted. Trades and quotes are timestamped to millisecond in TRTH. We group consecutive trades with the same price and the same trade sign into one if they are within one second from each other.

significantly due to the availability of trade and quote data. Interestingly, the scaled estimated coefficients for our French sample stocks, especially in the post-regulation period, are close to those reported in Sadka (2006) for NYSE-listed stocks in the period 1983 to 2001.

<< **Table 6 goes about here** >>

We conduct a similar DID test as in Table 2 with the permanent and transitory price impacts and report the results in Table 7. The DID results in Panel A indicate a significant increase in the transitory price impact for target stocks relative to non-target stocks in the post-FTT period. Turning to the permanent price impact in Panel B, we find a change in the opposite direction for target stocks following the FTT implementation. When comparing with all non-target stocks, target stocks still have a relative decrease in the permanent price impact in the post-regulation period, but the difference is not statistically significant.

<< **Table 7 goes about here** >>

Overall the results indicate that the information content of trades in target stocks decreases after the imposition of FTT. Hence the FTT is likely to deter informed trading and result in less informative stock prices.

## **5. Conclusion**

In this paper, we study the effect of the financial transaction tax on the market quality of affected stocks by examining a recently introduced FTT on large-cap stocks traded on the Euronext Paris. Overall our findings indicate that the FTT reduces trading and liquidity in taxed stocks. More

importantly, we find some evidence of trading migration from taxed stocks to UK large firms with similar fundamentals and less informed trades for taxed stocks.

Collectively, these findings suggest that it is challenging to achieve the FTT's intended objective of deterring speculative trading and price distortions. Instead, informed trading is likely to decline more than noise trading in taxed stocks, as sophisticated investors could bypass the FTT to some extent via trading in potential substitutes for taxed stocks. This would lead to less informed trades and noisier prices for taxed stocks. Future studies on the FTT could further explore the distorting effect of the FTT on trading by different types of investors and the asset pricing implications with more detailed data on investor trading.

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**Table 1**  
**Summary Statistics**

This table presents the summary statistics of liquidity measures and firm characteristics for our sample stocks traded on the Euronext Paris over the period January 2012 to March 2013. All variables are defined in Table A.2 in the Appendix. For liquidity measures, we report their statistics separately in the pre-regulation period (January 2012 to June 2012) and the post-regulation period (September 2012 to March 2013). All variables are winsorized cross-sectionally at the 1<sup>st</sup> and 99<sup>th</sup> percentile values.

<b>Variable</b>	<b>N</b>	<b>Mean</b>	<b>Std Dev</b>	<b>Minimum</b>	<b>Q1</b>	<b>Median</b>	<b>Q3</b>	<b>Maximum</b>
Liquidity measures in the pre-regulation period								
Turnover (%)	731	0.125	0.223	0.000	0.007	0.039	0.140	1.802
Bid-ask Spread (%)	645	2.525	5.129	0.017	0.338	0.802	1.946	47.655
Roll's Spread (%)	730	1.165	1.612	0.000	0.000	0.631	1.677	7.926
Liquidity measures in the post-regulation period								
Turnover (%)	731	0.105	0.177	0.000	0.008	0.039	0.116	1.289
Bid-ask Spread (%)	645	2.244	4.560	0.020	0.268	0.645	1.715	41.205
Roll's Spread (%)	730	1.069	1.573	0.000	0.000	0.582	1.391	8.911
Other firm characteristics								
Size	724	1.552	5.239	0.001	0.018	0.069	0.408	37.596
Volatility	720	0.497	0.390	0.041	0.279	0.389	0.565	3.015
Sales Growth	632	0.085	0.211	-0.402	0.000	0.044	0.140	1.304
CapEx	632	0.031	0.041	0.000	0.003	0.019	0.043	0.278
Analyst	731	1.138	1.684	0.000	0.000	1.000	1.000	8.000
Institutional Ownership	731	0.064	0.098	0.000	0.000	0.017	0.081	0.416
Age	708	15.894	9.103	1.000	8.000	15.000	23.000	40.000

**Table 2****The FTT and Liquidity: the Univariate DID Test**

This table presents the results of the univariate DID test of liquidity measures before and after the FTT implementation between stocks subject to the FTT (target stocks) and other stocks traded on the Euronext Paris (non-target stocks). All three liquidity measures are defined in Table A.2 in the Appendix. For each measure, we report the following statistics for both the target stock group (row “Target”) and the non-target stock group (row “Non-target”): the average value in the pre-regulation period (column “Pre”), the average value in the post-regulation period (column “Post”), and the average change from the pre-regulation period to the post-regulation period (column “Diff: Post-Pre”). When calculating the average value of a variable for a group, we weight stocks either equally (“Equal-weighted Average”) or by its market capitalization (“Value-weighted Average”). We then report the difference in liquidity or liquidity change and the associated t-value from a standard T-test between the target stock group and the non-target stock group (row “Target-Non-target”). Superscripts \*, \*\* and \*\*\* denote statistical significance at 10%, 5% and 1% levels respectively.

*Panel A. Turnover (%)*

Category	Stat.	Equal-weighted Average			Value-weighted Average		
		Pre	Post	Diff: Post-Pre	Pre	Post	Diff: Post-Pre
Target	Avg.	0.304	0.224	-0.079	0.316	0.223	-0.094
(N=108)	Std.	(0.026)	(0.022)	(0.008)	(0.021)	(0.014)	(0.009)
Non-target	Avg.	0.094	0.084	-0.010	0.17	0.172	0.002
(N=623)	Std.	(0.008)	(0.006)	(0.004)	(0.008)	(0.007)	(0.004)
<b>Diff:</b>							
Target–	Avg.	0.209***	0.140***	-0.069***	0.146***	0.050***	-0.096***
Non-target	T	(7.687)	(6.214)	(-7.521)	(6.592)	(3.174)	(-9.602)

*Panel B. Bid-ask Spread (%)*

Category	Stat.	Equal-weighted Average			Value-weighted Average		
		Pre	Post	Diff: Post-Pre	Pre	Post	Diff: Post-Pre
Target	Avg.	0.194	0.188	-0.007	0.071	0.073	0.002
(N=108)	Std.	(0.054)	(0.052)	(0.008)	(0.026)	(0.025)	(0.003)
Non-target	Avg.	2.993	2.657	-0.336	1.061	0.969	-0.092
(N=537)	Std.	(0.237)	(0.211)	(0.117)	(0.096)	(0.087)	(0.049)
<b>Diff:</b>							
Target–	Avg.	-2.799***	-2.469***	0.330***	-0.990***	-0.896***	0.094*
Non-target	T	(-11.505)	(-11.365)	(2.802)	(-9.925)	(-9.896)	(1.915)

(Table continued on next page)

**Table 2 (Continued)***Panel C. Roll's Spread (%)*

Category	Stat.	Equal-weighted Average			Value-weighted Average		
		Pre	Post	Diff: Post-Pre	Pre	Post	Diff: Post-Pre
Target	Avg.	0.581	0.668	0.086	0.639	0.874	0.235
(N=108)	Std.	(0.060)	(0.049)	(0.071)	(0.050)	(0.044)	(0.061)
Non-target	Avg.	1.268	1.139	-0.129	0.723	0.513	-0.209
(N=622)	Std.	(0.069)	(0.067)	(0.070)	(0.035)	(0.034)	(0.043)
<b>Diff:</b>							
Target–	Avg.	-0.686***	-0.471***	0.215**	-0.084	0.360***	0.444***
Non-target	T	(-7.518)	(-5.634)	(2.156)	(-1.380)	(6.426)	(5.948)

**Table 3****The FTT and Liquidity: the Multivariate Regression Analysis**

This table presents the OLS results for the following regression for our French sample stocks,

$$Liquidity_{i,t} = \beta_0 + \beta_1 * DM\_Target_{i,t} + \beta_2 * DM\_Post_{i,t} + \beta_3 * DM\_Target\_Post_{i,t} + Controls$$

The regression is run with the panel of stock-subperiod observations, where subperiods refer to the pre-regulation period and the post-regulation period respectively. The dependent variable is a stock's average or estimated value of the relevant liquidity measure in a subperiod. DM\_Target is a dummy variable taking the value one for target stocks and zero otherwise. DM\_Post is a dummy variable taking the value one for the post-regulation period and zero otherwise. DM\_Target\_Post, the multiplication of these two dummy variables. Liquidity measures and other firm characteristics are defined in Table A.2 in the Appendix. We include industry fixed effects in the regression, where industries are defined by 2-digit GICS codes, but suppress their results to save space. The t-statistics shown in parentheses are calculated based on coefficients' standard errors with firm clustering. Superscripts \*, \*\* and \*\*\* denote statistical significance at 10%, 5% and 1% levels respectively.

<b>Variable</b>	<b>Turnover(%)</b>	<b>Bid-ask Spread(%)</b>	<b>Roll's Spread(%)</b>
Intercept	0.229*** (2.742)	6.715*** (6.357)	2.955*** (8.028)
DM_Target	0.086*** (2.710)	1.367** (2.559)	0.342** (2.270)
DM_Post	-0.010** (-2.112)	-0.286** (-2.551)	-0.196** (-2.532)
DM_Target_Post	-0.070*** (-7.311)	0.279** (2.483)	0.280*** (2.653)
Log(Size)	0.017** (2.395)	-0.669*** (-3.414)	-0.124*** (-2.773)
Log(Volatility)	0.130*** (6.391)	2.075*** (5.057)	1.040*** (8.256)
Sales Growth	-0.007 (-0.096)	-0.430 (-0.740)	-0.280 (-1.033)
CapEx	-0.362*** (-2.796)	-8.621*** (-2.897)	-1.496 (-1.014)
Log(1+Analyst)	-0.004 (-0.229)	-0.458** (-2.219)	-0.280*** (-3.652)
Log(1+Institutional Ownership*100)	0.033*** (4.255)	-0.388*** (-3.561)	-0.136*** (-3.028)
Log(Age)	-0.016 (-1.438)	0.548*** (2.698)	0.053 (0.688)
DM_CAC40	0.109*** (2.691)	0.788** (2.253)	0.344** (2.357)
Industry Fixed Effects	Yes	Yes	Yes
Number of Observations	1,222	1,180	1,222
Adjusted R-squared	0.272	0.288	0.265

**Table 4****The FTT and Liquidity: the Univariate DID Test Using UK Large Stocks as the Control Group**

This table presents the results of the univariate DID test of liquidity measures before and after the FTT implementation between stocks subject to the FTT (target stocks) and large stocks listed on London Stock Exchange and having a market capitalization over one billion euros as of January 1<sup>st</sup> 2012 (UK large stocks). All three liquidity measures are defined in Table A.2 in the Appendix. For each measure, we report the following statistics for both the target stock group (row “French Target”) and UK large stocks (row “UK Large”): the average value in the pre-regulation period (column “Pre”), the average value in the post-regulation period (column “Post”), and the average change from the pre-regulation period to the post-regulation period (column “Diff: Post-Pre”). When calculating the average value of a variable for a group, we weight stocks either equally (“Equal-weighted Average”) or by its market capitalization (“Value-weighted Average”). Finally, we report the difference in liquidity or liquidity change and the associated t-value from a standard T-test between the target stock group and the non-target stock group (row “French Target-UK Large”) and the associated t-value from a standard T-test. Superscripts \*, \*\* and \*\*\* denote statistical significance at 10%, 5% and 1% levels respectively.

*Panel A. Turnover (%)*

Category	Stat.	Equal-weighted Average			Value-weighted Average		
		Pre	Post	Diff: Post-Pre	Pre	Post	Diff: Post-Pre
French Target	Avg.	0.304	0.224	-0.079	0.316	0.223	-0.094
(N=108)	Std.	(0.026)	(0.022)	(0.008)	(0.021)	(0.014)	(0.009)
UK Large	Avg.	0.266	0.221	-0.045	0.217	0.187	-0.030
(N=189)	Std.	(0.011)	(0.009)	(0.006)	(0.008)	(0.006)	(0.004)
<b>Diff:</b>							
French Target–	Avg.	0.038	0.003	-0.035***	0.099***	0.036**	-0.063***
UK Large	T	(1.351)	(0.144)	(-3.354)	(4.508)	(2.318)	(-6.464)

*Panel B. Bid-ask Spread (%)*

Category	Stat.	Equal-weighted Average			Value-weighted Average		
		Pre	Post	Diff: Post-Pre	Pre	Post	Diff: Post-Pre
French Target	Avg.	0.194	0.188	-0.007	0.071	0.073	0.002
(N=108)	Std.	(0.054)	(0.052)	(0.008)	(0.026)	(0.025)	(0.003)
UK Large	Avg.	0.102	0.089	-0.013	0.042	0.034	-0.008
(N=189)	Std.	(0.017)	(0.015)	(0.005)	(0.007)	(0.007)	(0.002)
<b>Diff:</b>							
French Target–	Avg.	0.092	0.099*	0.007	0.029	0.039	0.010***
UK Large	T	(1.605)	(1.797)	(0.632)	(1.091)	(1.498)	(2.752)

(Table continued on next page)

**Table 4 (Continued)***Panel C. Roll's Spread (%)*

Category	Stat.	Equal-weighted Average			Value-weighted Average		
		Pre	Post	Diff: Post-Pre	Pre	Post	Diff: Post-Pre
French Target	Avg.	0.581	0.668	0.086	0.639	0.874	0.235
(N=108)	Std.	(0.060)	(0.049)	(0.071)	(0.050)	(0.044)	(0.061)
UK Large	Avg.	0.650	0.554	-0.097	0.732	0.529	-0.202
(N=189)	Std.	(0.048)	(0.042)	(0.061)	(0.034)	(0.034)	(0.044)
<b>Diff:</b>							
French Target–	Avg.	-0.069	0.114*	0.183**	-0.093	0.344***	0.437***
UK Large	T	(-0.896)	(1.755)	(1.961)	(-1.540)	(6.151)	(5.838)

**Table 5****The FTT and Trading Migration: The Univariate DID Test between Target Stocks, Potential Substitute Stocks, and Other Non-Target Stocks**

This table presents the results of the univariate DID test of turnover before and after the FTT implementation between stocks subject to the FTT (target stocks) and selected groups of stocks not subject to the FTT (non-target stocks). We separate non-target stocks into potential trading substitute for target stocks and other non-target stocks. The potential trading substitute of a target stock is identified as the one that had the highest partial correlation in daily returns with the taxed one in the pre-FTT period, after controlling for the market returns, among all non-target stocks. We report the following statistics of turnover (expressed in percentage points and defined in Table A.2 in the Appendix) for the target stock group (row “Target”), the potentially substitute stock group (row “Substitute”) and other non-target stock group (row “Other non-target”): the average value in the pre-regulation period (column “Pre”), the average value in the post-regulation period (column “Post”), and the average change from the pre-regulation period to the post-regulation period (column “Diff: Post-Pre”). When calculating the average value of a variable for a group, we weight stocks either equally (“Equal-weighted Average”) or by its market capitalization (“Value-weighted Average”). Finally, we report the difference in turnover or turnover change and the associated t-value from a standard T-test between the target stock group and the potentially substitute stock group (row “Target-Substitute”), between the target stock group and other non-target stock group (row “Target-Other non-target”), and between the potentially substitute stock group and other non-target stock group (row “Substitute-Other non-target”) respectively.

In Panel A, both substitute and other non-target stocks are selected from stocks listed on London Stock Exchange having a market capitalization over one billion euros as of January 1<sup>st</sup> 2012, while in Panel B, they are selected from non-taxed stocks traded on the Euronext Paris. When calculating the partial correlation in daily returns between target stocks and UK stocks, we control both French and UK market returns.

Superscripts \*, \*\* and \*\*\* denote statistical significance at 10%, 5% and 1% levels respectively.

*Panel A. Selecting substitute and other non-target stocks from UK large stocks*

Category	Stat.	Equal-weighted Average			Value-weighted Average		
		Pre	Post	Diff: Post-Pre	Pre	Post	Diff: Post-Pre
Target	Avg.	0.304	0.224	-0.079	0.316	0.223	-0.094
(N=108)	Std.	(0.026)	(0.022)	(0.008)	(0.021)	(0.014)	(0.009)
Substitute	Avg.	0.264	0.233	-0.031	0.198	0.183	-0.015
(N=76)	Std.	(0.012)	(0.012)	(0.008)	(0.010)	(0.009)	(0.005)
Other non-target	Avg.	0.264	0.210	-0.054	0.233	0.189	-0.044
(N=113)	Std.	(0.015)	(0.012)	(0.008)	(0.010)	(0.008)	(0.005)
<b>Diff:</b>							
Target–	Avg.	0.039	-0.009	-0.048***	0.118***	0.039**	-0.079***
Substitute	T	(1.366)	(-0.357)	(-4.180)	(5.168)	(2.355)	(-7.692)
Target–	Avg.	0.040	0.014	-0.025**	0.083***	0.034**	-0.050***
Other non-target	T	(1.325)	(0.580)	(-2.210)	(3.614)	(2.076)	(-4.828)
Substitute–	Avg.	0.000	0.023	0.023**	-0.035**	-0.005	0.029***
Other non-target	T	(0.023)	(1.391)	(2.001)	(-2.411)	(-0.464)	(4.126)

(Table continued on next page)

**Table 5 (Continued)***Panel B. Selecting substitute and other non-target stocks from French non-taxed stocks*

Category	Stat.	Equal-weighted Average			Value-weighted Average		
		Pre	Post	Diff: Post-Pre	Pre	Post	Diff: Post-Pre
Target	Avg.	0.304	0.224	-0.079	0.316	0.223	-0.094
(N=108)	Std.	(0.026)	(0.022)	(0.008)	(0.021)	(0.014)	(0.009)
Substitute	Avg.	0.132	0.127	-0.005	0.191	0.232	0.041
(N=73)	Std.	(0.029)	(0.026)	(0.011)	(0.018)	(0.018)	(0.010)
Other non-target	Avg.	0.089	0.078	-0.011	0.157	0.135	-0.022
(N=550)	Std.	(0.008)	(0.006)	(0.004)	(0.010)	(0.007)	(0.005)
<b>Diff:</b>							
Target–	Avg.	0.172***	0.097***	-0.074***	0.125***	-0.010	-0.135***
Substitute	T	(4.438)	(2.870)	(-5.342)	(4.539)	(-0.431)	(-10.286)
Target–	Avg.	0.215***	0.146***	-0.069***	0.159***	0.088***	-0.071***
Other non-target	T	(7.854)	(6.473)	(-7.338)	(6.979)	(5.489)	(-6.928)
Substitute–	Avg.	0.043	0.049*	0.006	0.034	0.098***	0.064***
Other non-target	T	(1.436)	(1.816)	(0.495)	(1.634)	(5.040)	(5.842)

**Table 6**  
**Summary Statistics for Parameters of the Price Impact Decomposition**

This table presents the summary statistics of the price impact decomposition parameters for our sample stocks traded on the Euronext Paris over the period January 2012 to March 2013. We first estimate the following OLS regression for each stock each month,

$$\Delta p_t = \Psi D_t + \lambda DV_t + \bar{\Psi} \Delta D_t + \bar{\lambda} \Delta DV_t + y_t.$$

The regression is run with transaction-level observations.  $\Delta p_t$  is the change in transaction price from the previous one.  $D_t$  is the trade direction indicator, taking the value one for buy-initiated trades and negative one for sell-initiated trades, where trades are classified using the algorithm in Lee and Ready (1991).  $DV_t$  is the product of  $D_t$  and trade size  $V_t$ .  $\Delta D_t$  and  $\Delta DV_t$  are changes in  $D_t$  and  $DV_t$  from the previous transaction respectively.  $\Psi$ ,  $\lambda$ ,  $\bar{\Psi}$ , and  $\bar{\lambda}$  are the permanent fixed, permanent variable, transitory fixed, and transitory variable price impact coefficients respectively to be estimated from the regression. We first scale the four coefficients of a stock in a month by the stock's average transaction price in the month and then winsorize them cross-sectionally within each month at 1 and 99 percentile values respectively. We calculate the permanent and transitory price impacts of trading 1000 shares from the price-scaled coefficients as  $(\Psi + \lambda * 1000)$  and  $(\bar{\Psi} + \bar{\lambda} * 1000)$  respectively. Finally we calculate the average values of the price-scaled coefficients, the permanent price impact and the transitory price impact for each stock, separately in the pre-regulation period (January 2012 to June 2012) and the post-regulation period (September 2012 to March 2013).

Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
<i>Panel A. Parameters in the Pre-Regulation Period (%)</i>								
$\Psi$	417	0.194	0.225	0.008	0.033	0.110	0.268	1.328
$\lambda * 10^3$	417	-0.007	0.278	-1.915	-0.001	0.008	0.037	1.286
$\bar{\Psi}$	417	0.342	0.432	-0.032	0.051	0.203	0.449	2.646
$\bar{\lambda} * 10^3$	417	-0.012	0.224	-1.355	-0.030	-0.004	0.002	2.148
Permanent price impact	417	0.187	0.298	-1.039	0.026	0.103	0.268	1.551
Transitory price impact	417	0.330	0.493	-1.048	0.032	0.170	0.422	3.296
<i>Panel B. Parameters in the Post-Regulation Period (%)</i>								
$\Psi$	417	0.176	0.221	0.001	0.027	0.087	0.213	1.122
$\lambda * 10^3$	417	0.020	0.228	-1.096	-0.004	0.005	0.026	2.089
$\bar{\Psi}$	417	0.298	0.472	-0.072	0.043	0.145	0.360	3.461
$\bar{\lambda} * 10^3$	417	-0.015	0.172	-0.988	-0.032	-0.005	0.001	1.187
Permanent price impact	417	0.196	0.320	-0.726	0.025	0.094	0.220	3.057
Transitory price impact	417	0.283	0.491	-0.471	0.023	0.132	0.331	3.458

**Table 7****The FTT and the Price Impact Components: The Univariate DID Test**

This table presents the results of the univariate DID test of price impact components before and after the FTT implementation between stocks subject to the FTT (target stocks) and other stocks traded on the Euronext Paris (non-target stocks). The procedure to estimate the permanent and transitory price impact measures are described in Table 6. For each measure, we report the following statistics for both the target stock group (row “Target”) and the non-target stock group (row “Non-target”): the average value in the pre-regulation period (column “Pre”), the average value in the post-regulation period (column “Post”), and the average change from the pre-regulation period to the post-regulation period (column “Diff: Post-Pre”). When calculating the average value of a variable for a group, we weight stocks either equally (“Equal-weighted Average”) or by its market capitalization (“Value-weighted Average”). We then report the difference in the price impact or the price impact change and the associated t-value from a standard T-test between the target stock group and the non-target stock group (row “Target-Non-target”). Superscripts \*, \*\* and \*\*\* denote statistical significance at 10%, 5% and 1% levels respectively.

*Panel A. Transitory Price Impact (%)*

Category	Stat.	Equal-weighted Average			Value-weighted Average		
		Pre	Post	Diff: Post-Pre	Pre	Post	Diff: Post-Pre
Target	Avg.	0.033	0.029	-0.004	0.012	0.017	0.006
(N=106)	Std.	(0.010)	(0.011)	(0.017)	(0.005)	(0.009)	(0.012)
Non-target	Avg.	0.431	0.370	-0.061	0.163	0.127	-0.036
(N=311)	Std.	(0.030)	(0.031)	(0.022)	(0.017)	(0.012)	(0.012)
<b>Diff:</b>							
Target–	Avg.	-0.398***	-0.341***	0.057**	-0.152***	-0.110***	0.042**
Non-target	T	(-12.556)	(-10.487)	(2.060)	(-8.676)	(-7.444)	(2.440)

*Panel B. Permanent Price Impact (%)*

Category	Stat.	Equal-weighted Average			Value-weighted Average		
		Pre	Post	Diff: Post-Pre	Pre	Post	Diff: Post-Pre
Target	Avg.	0.029	0.023	-0.007	0.021	0.013	-0.008
(N=106)	Std.	(0.011)	(0.009)	(0.014)	(0.006)	(0.006)	(0.009)
Non-target	Avg.	0.241	0.255	0.014	0.105	0.122	0.017
(N=311)	Std.	(0.018)	(0.020)	(0.019)	(0.010)	(0.014)	(0.013)
<b>Diff:</b>							
Target–	Avg.	-0.212***	-0.232***	-0.021	-0.084***	-0.110***	-0.025
Non-target	T	(-9.858)	(-10.754)	(-0.872)	(-7.343)	(-7.347)	(-1.581)

## Appendix

**Table A.1 List of Stocks Subject to the FTT**

This table lists 109 stocks subject to the FTT when it became effective on August 1<sup>st</sup> 2012. We obtain the list from the French government website

<http://www.legifrance.gouv.fr/affichTexte.do;jsessionid=?cidTexte=JORFTEXT000026178804&dateTexte=&oldAction=rechJO&categorieLien=id>. We also provide identifiers in various databases for each stock: ISIN is the International Securities Identification Number; DS code and TRTH RIC are the security identifiers in Datastream and Thomson Reuters Tick History respectively.

Sequence	Abbreviated Company Name	ISIN	DS Code	TRTH RIC
1	Accor.	FR0000120404	929363	ACCP.PA
2	ADP.	FR0010340141	36066K	ADP.PA
3	Air France-KLM.	FR0000031122	929286	AIRF.PA
4	Air Liquide.	FR0000120073	923295	AIRP.PA
5	Alcate-Lucent.	FR0000130007	755022	ALUA.PA
6	Alstom.	FR0010220475	682858	ALSO.PA
7	Altea.	FR0000033219	772684	IMAF.PA
8*	APRR	FR0006807004	29786H	APRR.PA
9	Areva.	FR0011027143	307655	AREVA.PA
10	Arkema.	FR0010313833	35720C	AKE.PA
11	Atos.	FR0000051732	740622	ATOS.PA
12	Axa.	FR0000120628	936732	AXAF.PA
13	Bel Cheese.	FR0000121857	929228	FROB.PA
14	Bic.	FR0000120966	930885	BICP.PA
15	Biomerieux.	FR0010096479	29169X	BIOX.PA
16	BNP Paribas.	FR0000131104	309449	BNPP.PA
17	Bolloré.	FR0000039299	997966	BOLL.PA
18	Bourbon.	FR0004548873	685788	GPBN.PA
19	Bouygues.	FR0000120503	923500	BOUY.PA
20	Bureau Veritas.	FR0006174348	51185D	BVI.PA
21	Cambodia (the company).	FR0000079659	936588	CCAP.PA
22	Cap Gemini.	FR0000125338	702043	CAPP.PA
23	Carrefour.	FR0000120172	922029	CARR.PA
24	Casino Guichard.	FR0000125585	923254	CASP.PA
25	CFAO.	FR0000060501	68419M	CFAO.PA
26	CGG Veritas.	FR0000120164	998054	GEPH.PA
27	Christian Dior.	FR0000130403	539616	DIOR.PA
28	CIC.	FR0005025004	682851	CC.PA
29	CNP Assurances.	FR0000120222	685687	CNPP.PA
30	Colas.	FR0000121634	929247	COLP.PA
31	Crédit Agricole.	FR0000045072	14866R	CAGR.PA
32	Danone.	FR0000120644	912833	DANO.PA
33	Dassault Aviation.	FR0000121725	936564	AVMD.PA
34	Dassault Systèmes.	FR0000130650	866708	DAST.PA

35	EDF.	FR0010242511	32269V	EDF.PA
36	Eiffage.	FR0000130452	936469	FOUG.PA
37	Endered.	FR0010908533	69633H	EDEN.PA
38	Eramet.	FR0000131757	143191	ERMT.PA
39	Essilor Intl.	FR0000121667	936514	ESSI.PA
40	Euler Hermes.	FR0004254035	289127	ELER.PA
41	Eurazeo.	FR0000121121	923284	EURA.PA
42	Eutelsat Communications.	FR0010221234	32057D	ETL.PA
43	Faurecia.	FR0000121147	937211	EPED.PA
44	FDL.	FR0000030181	776580	FODL.PA
45	FDR.	FR0000064578	772623	FDR.PA
46	Financial Odet.	FR0000062234	936644	EPMF.PA
47	France Telecom.	FR0000133308	885569	FTE.PA
48	French cement.	FR0000120982	929173	CMFP.PA
49	GDF Suez.	FR0010208488	31270N	GSZ.PA
50	Gecina.	FR0010040865	936866	GFCP.PA
51	Groupe Eurotunnel.	FR0010533075	50767F	GETP.PA
52	Havas.	FR0000121881	936677	EURC.PA
53	Hermes Intl.	FR0000052292	309037	HRMS.PA
54	Icade.	FR0000035081	929291	ICAD.PA
55	Iliad.	FR0004035913	28400H	ILD.PA
56	Imerys.	FR0000120859	912049	IMTP.PA
57	Ingenico.	FR0000125346	921366	INGC.PA
58	Ipsen.	FR0010259150	32376D	IPN.PA
59	JC Decaux SA.	FR0000077919	259244	JCDX.PA
60	Klepierre.	FR0000121964	776602	LOIM.PA
61	Lafarge.	FR0000120537	916745	LAFP.PA
62	Lagardère SCA.	FR0000130213	998500	LAGA.PA
63	Legrand.	FR0010307819	35612E	LEGD.PA
64	L'Oréal.	FR0000120321	923386	OREP.PA
65	LVMH.	FR0000121014	916658	LVMH.PA
66	Maurel et Prom.	FR0000051070	505969	MAUP.PA
67	Mercialys.	FR0010241638	31988J	MERY.PA
68	Metropole TV.	FR0000053225	143198	MMTP.PA
69	Michelin.	FR0000121261	912397	MICP.PA
70	Natixis.	FR0000120685	929283	CNAT.PA
71	Neopost.	FR0000120560	692552	NPOS.PA
72	Nexans.	FR0000044448	259181	NEXS.PA
73	Orpea.	FR0000184798	15406Q	ORP.PA
74	Pernod Ricard.	FR0000120693	923539	PERP.PA
75	Peugeot.	FR0000121501	912709	PEUP.PA
76	PPR.	FR0000121485	923657	P RTP.PA
77	Publicis Groupe SA.	FR0000130577	936775	PUBP.PA
78	Rally.	FR0000060618	729209	GENC.PA

79	Remy Cointreau.	FR0000130395	307428	RCOP.PA
80	Renault.	FR0000131906	143366	RENA.PA
81	Rexel.	FR0010451203	50367K	RXL.PA
82	Ruby.	FR0000121253	929242	RUBF.PA
83	Safran.	FR0000073272	929273	SAF.PA
84	Saint-Gobain.	FR0000125007	741689	SGOB.PA
85	Sanofi.	FR0000120578	992594	SASY.PA
86	Schneider Electric.	FR0000121972	998075	SCHN.PA
87	Scor Se.	FR0010411983	776500	SCOR.PA
88	SEB.	FR0000121709	936411	SEBF.PA
89	SFL.	FR0000033409	929165	FLYP.PA
90	Silic.	FR0000050916	930145	SILP.PA
91	Société Générale.	FR0000130809	755457	SOGN.PA
92	Sodexo.	FR0000121220	993597	EXHO.PA
93	Somfy SA.	FR0000120495	982099	DAMA.PA
94	Suez Environnement.	FR0010613471	53595N	SEVI.PA
95	Technip.	FR0000131708	143241	TECF.PA
96	TF1.	FR0000054900	755793	TFFP.PA
97	Thales.	FR0000121329	923543	TCFP.PA
98	Total.	FR0000120271	912398	TOTF.PA
99	Unibail-Rodamco.	FR0000124711	932422	UNBP.AS
100	Valeo.	FR0000130338	922053	VLOF.PA
101	Vallourec.	FR0000120354	929267	VLLP.PA
102	Veolia Environnement.	FR0000124141	289374	VIE.PA
103	Vicat.	FR0000031775	997836	VCTP.PA
104	Vilmorin & Cie.	FR0000052516	309810	VILM.PA
105	Vinci.	FR0000125486	772568	SGEF.PA
106	Virbac.	FR0000031577	772692	VIRB.PA
107	Vivendi.	FR0000127771	923139	VIV.PA
108	Wendel.	FR0000121204	929215	MWDP.PA
109	Zodiac Aerospace.	FR0000125684	993501	ZODC.PA

\* This stock was delisted from the Euronext Paris on December 18, 2012.

**Table A.2 Variable Definitions**

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Turnover	The average of daily share turnover within the pre-regulation period or the post-regulation period for a stock, where daily share turnover is calculated as the ratio of daily number of shares traded to the number of shares outstanding
Bid-ask Spread	The average of daily bid-ask spread within the pre-regulation period or the post-regulation period for a stock, where daily bid-ask spread is calculated from close bid and ask prices as $(ask - bid) / (ask + bid)$
Roll's Spread	The Roll's spread measure in the pre-regulation period or the post-regulation period for a stock, calculated as $2\sqrt{-Cov}$ , where Cov is the sample autocovariance of daily returns in the period and is set to zero if positive
Size	The market capitalization in billions of Euro-dollars at the end of the year 2011 for a stock
Volatility	The standard deviation of daily returns in 2011 for a stock, multiplied by the squared root of 252 to obtain the annualized value
Sales Growth	The percentage increase in sales from the 2010 financial year to the 2011 financial year for a firm
CapEx	The capital expenditure in the 2011 financial year scaled by the total assets at the end of 2011 financial year for a firm
Analyst	The number of analysts making one-year-ahead earnings forecasts in December 2011 for a stock, set to zero if not covered by any analyst
Institutional Ownership	The percentage of shares outstanding held by institutional investors for a stock at the end of 2011, set to zero if not held by any institutional investor.
Age	The number of years since listing for a firm, calculated as the difference between the sample ending year 2013 and the first year when the firm's stock appeared in the daily market data
DM_CAC40	CAC 40 index component indicator for a stock, taking the value one if the stock was included in CAC 40 index as of the end of 2011 and zero otherwise

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**Table A.3****The FTT and Liquidity: the Amihud Illiquidity Measure**

Panel A presents the results of the univariate DID test of the Amihud illiquidity measure before and after the FTT implementation between stocks subject to the FTT (target stocks) and other stocks traded on the Euronext Paris (non-target stocks). For each stock, daily Amihud illiquidity measure is calculated as one million times the ratio of the absolute value of daily return to daily dollar trading volume. We take natural logarithm of 1+Amihud, as the variable is highly skewed, and daily Amihud illiquidity measure is averaged within a period, e.g., the pre-regulation period or the post-regulation period, to obtain the Amihud illiquidity measure for each period. We report the following statistics of the Amihud illiquidity measure for both the target stock group (row “Target”) and the non-target stock group (row “Non-target”): the average value in the pre-regulation period (column “Pre”), the average value in the post-regulation period (column “Post”), and the average change from the pre-regulation period to the post-regulation period (column “Diff: Post-Pre”). When calculating the average value for a group, we weight stocks either equally (“Equal-weighted Average”) or by its market capitalization (“Value-weighted Average”). We then report the difference in the Amihud illiquidity measure or its change and the associated t-value from a standard T-test between the target stock group and the non-target stock group (row “Target-Non-target”). Superscripts \*, \*\* and \*\*\* denote statistical significance at 10%, 5% and 1% levels respectively.

Panel B presents the OLS results for the following regression using stock-subperiod observations, where subperiods refer to the pre-regulation period and the post-regulation period respectively,

$$Amihud_{i,t} = \beta_0 + \beta_1 * DM\_Target_{i,t} + \beta_2 * DM\_Post_{i,t} + \beta_3 * DM\_Target\_Post_{i,t} + Controls$$

The dependent variable is a stock’s average Amihud illiquidity measure value in a subperiod. DM\_Target is a dummy variable taking the value one for target stocks and zero otherwise. DM\_Post is a dummy variable taking the value one for the post-regulation period and zero otherwise. DM\_Target\_Post, the multiplication of these two dummy variables. We include industry fixed effects in the regression, where industries are defined by 2-digit GICS codes. Other control variables are defined in Table A.2 in the Appendix. We report the coefficients of main variables of interest for simplicity. The t-statistics shown in parentheses are calculated based on coefficients’ standard errors with firm clustering. Superscripts \*, \*\* and \*\*\* denote statistical significance at 10%, 5% and 1% levels respectively.

*Panel A. The univariate DID test*

Category	Stat.	Equal-weighted Average			Value-weighted Average		
		Pre	Post	Diff: Post-Pre	Pre	Post	Diff: Post-Pre
Target	Avg.	0.044	0.030	-0.014	0.008	0.006	-0.003
(N=107)	Std.	(0.017)	(0.013)	(0.005)	(0.006)	(0.005)	(0.002)
Non-target	Avg.	0.800	0.723	-0.077	0.174	0.146	-0.029
(N=450)	Std.	(0.038)	(0.036)	(0.016)	(0.017)	(0.015)	(0.006)
<b>Diff:</b>							
Target–	Avg.	-0.755***	-0.692***	0.063***	-0.166***	-0.140***	0.026***
Non-target	T	(-18.202)	(-17.917)	(3.763)	(-9.246)	(-8.817)	(3.833)

(Table continued on next page)

**Table A.3 (Continued)***Panel B. Multivariate regression*

	<b>DM_Target</b>	<b>DM_Post</b>	<b>DM_Target_Post</b>	<b>Controls</b>	<b>Number of Observations</b>	<b>Adjusted R-squared</b>
Coefficient	0.423***	-0.077***	0.063***			
T	(6.218)	(-4.803)	(3.722)	Yes	1038	0.534

**Table A.4****The FTT and Liquidity between Taxed Stocks and Their Industry Peers: the Univariate DID Test**

This table presents the results of the univariate DID test of liquidity measures before and after the FTT implementation between stocks subject to the FTT and their industry peers traded on the Euronext Paris. For each taxed stock in each industry as indicated by the 2-digit GICS industry code, we choose, without replacement and subject to availability, up to N (N= 1, 3, and 5) largest non-taxed stocks in the same industry as control stocks. For both target group (Target) and industry control group (Industry), we report the average value of their post- versus pre-regulation changes in liquidity measures, and the difference in the liquidity change between target and control groups (DIF). Superscripts \*, \*\* and \*\*\* denote statistical significance at 10%, 5% and 1% levels respectively.

Liquidity Measures	Stat.	Equal-weighted Average Post-vs-Pre Change			Value-weighted Average Post-vs-Pre Change		
		Target	Industry	DIF	Target	Industry	DIF
Selecting one control stock for each taxed stock							
Turover (%)	Avg.	-0.079	-0.019	-0.060***	-0.094	0.012	-0.106***
	T	(-9.601)	(-2.456)	(-5.308)	(-10.450)	(1.679)	(-9.197)
Bid-ask Spread (%)	Avg.	-0.007	-0.021	0.015	0.002	-0.006	0.008
	T	(-0.812)	(-0.373)	(0.255)	(0.685)	(-0.121)	(0.165)
Roll's Spread (%)	Avg.	0.086	0.029	0.057	0.237	-0.254	0.492***
	T	(1.217)	(0.282)	(0.454)	(3.853)	(-2.792)	(4.471)
Selecting three control stocks for each taxed stock							
Turover (%)	Avg.	-0.079	-0.012	-0.067***	-0.094	0.004	-0.097***
	T	(-9.601)	(-2.031)	(-6.561)	(-10.45)	(0.588)	(-8.889)
Bid-ask Spread (%)	Avg.	-0.007	-0.266	0.259***	0.002	-0.057	0.059
	T	(-0.812)	(-2.862)	(2.781)	(0.685)	(-1.378)	(1.425)
Roll's Spread (%)	Avg.	0.086	-0.081	0.167	0.237	-0.208	0.445***
	T	(1.217)	(-1.056)	(1.602)	(3.853)	(-3.647)	(5.305)
Selecting five control stocks for each taxed stock							
Turover (%)	Avg.	-0.079	-0.011	-0.068***	-0.094	0.003	-0.096***
	T	(-9.601)	(-2.49)	(-7.17)	(-10.45)	(0.488)	(-9.259)
Bid-ask Spread (%)	Avg.	-0.007	-0.345	0.339**	0.002	-0.087	0.089
	T	(-0.812)	(-2.639)	(2.584)	(0.685)	(-1.564)	(1.599)
Roll's Spread (%)	Avg.	0.086	-0.061	0.147	0.237	-0.211	0.448***
	T	(1.217)	(-0.836)	(1.448)	(3.853)	(-4.257)	(5.670)

**Table A.5****The FTT and Liquidity: the Univariate DID Test, Dropping Non-taxed Stocks with the Market Capitalization below the Median Value**

This table presents the results of the univariate DID test of liquidity measures before and after the FTT implementation between stocks subject to the FTT (target stocks) and other stocks traded on the Euronext Paris (non-target stocks). We drop those non-taxed stocks with the market capitalization below the median value among all French non-taxed stocks. All three liquidity measures are defined in Table A.2 in the Appendix. For each measure, we report the following statistics for both the target stock group (row “Target”) and the non-target stock group (row “Non-target”): the average value in the pre-regulation period (column “Pre”), the average value in the post-regulation period (column “Post”), and the average change from the pre-regulation period to the post-regulation period (column “Diff: Post-Pre”). When calculating the average value of a variable for a group, we weight stocks either equally (“Equal-weighted Average”) or by its market capitalization (“Value-weighted Average”). We then report the difference in liquidity or liquidity change and the associated t-value from a standard T-test between the target stock group and the non-target stock group (row “Target-Non-target”). Superscripts \*, \*\* and \*\*\* denote statistical significance at 10%, 5% and 1% levels respectively.

*Panel A. Turnover (%)*

Category	Stat.	Equal-weighted Average			Value-weighted Average		
		Pre	Post	Diff: Post-Pre	Pre	Post	Diff: Post-Pre
Target	Avg.	0.304	0.224	-0.079	0.316	0.223	-0.094
(N=108)	Std.	(0.026)	(0.022)	(0.008)	(0.021)	(0.014)	(0.009)
Non-target	Avg.	0.103	0.091	-0.012	0.173	0.176	0.003
(N=313)	Std.	(0.012)	(0.009)	(0.006)	(0.012)	(0.010)	(0.006)
<b>Diff:</b>							
Target–	Avg.	0.201***	0.133***	-0.067***	0.143***	0.047***	-0.096***
Non-target	T	(6.966)	(5.661)	(-6.675)	(6.051)	(2.725)	(-8.819)

*Panel B. Bid-ask Spread (%)*

Category	Stat.	Equal-weighted Average			Value-weighted Average		
		Pre	Post	Diff: Post-Pre	Pre	Post	Diff: Post-Pre
Target	Avg.	0.194	0.188	-0.007	0.071	0.073	0.002
(N=108)	Std.	(0.054)	(0.052)	(0.008)	(0.026)	(0.025)	(0.003)
Non-target	Avg.	1.339	1.207	-0.132	0.940	0.890	-0.051
(N=288)	Std.	(0.147)	(0.141)	(0.057)	(0.110)	(0.109)	(0.038)
<b>Diff:</b>							
Target–	Avg.	-1.145***	-1.019***	0.126**	-0.869***	-0.816***	0.053
Non-target	T	(-7.303)	(-6.773)	(2.175)	(-7.713)	(-7.273)	(1.388)

(Table continued on next page)

**Table A.5 (Continued)**  
*Panel C. Roll's Spread (%)*

Category	Stat.	Equal-weighted Average			Value-weighted Average		
		Pre	Post	Diff: Post-Pre	Pre	Post	Diff: Post-Pre
Target	Avg.	0.581	0.668	0.086	0.639	0.874	0.235
(N=108)	Std.	(0.060)	(0.049)	(0.071)	(0.050)	(0.044)	(0.061)
Non-target	Avg.	0.859	0.660	-0.199	0.690	0.475	-0.215
(N=312)	Std.	(0.070)	(0.053)	(0.074)	(0.044)	(0.043)	(0.058)
<b>Diff:</b>							
Target–	Avg.	-0.278***	0.008	0.286***	-0.051	0.399***	0.450***
Non-target	T	(-3.015)	(0.105)	(2.791)	(-0.771)	(6.431)	(5.345)

**Figure A.1**  
**CAC 40 Index over the Sample Period**

This figure plots the CAC 40 Index over the sample period January 2012 to March 2013.

